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The compatibility of modern slaughter techniques with Halal slaughter: A review of the aspects of “modern” slaughter methods that divide scholarly opinion within the Muslim community.

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Abstract

The continuous expansion of the global Halal meat market has attracted interest from governments, food business operators and the animal and meat science research fraternity. Despite this growing trend, and the enormous economic benefits associated with it, there is lack of clarity regarding what is “authentic” Halal. Many Islamic jurists are reluctant to approve animal slaughter methods that were not practiced at the time of the Prophet of Islam, Mohammed. Others insist that since Islam holds animal welfare in high regard, any modern method of slaughter that is shown to improve animal welfare without compromising on the basic requirements of Halal slaughter can be approved for Halal production. This paper highlights the aspects of modern slaughter that continues to divide scholarly opinion among Islamic jurists. It also examines the arguments put forward by opponents and proponents regarding the acceptability of modern slaughter techniques for Halal slaughter.

Keywords

Animal Welfare; Halal slaughter; Thoracic Sticking; Pre-slaughter Stunning; Mechanical Slaughter; bleeding-out

1. Introduction

Animals have been slaughtered for food since time immemorial. Despite the emphasis on the humaneness of slaughter today, it has been reported that less attention was paid to the

humaneness of the slaughter techniques used in recent centuries (MacLachlan 2006; Zivotofsky and Strous 2012). It must be noted that at that time, there were no stunning equipment because the science of animal behaviour and our understanding of animal welfare were still in their infancy in comparison with present day knowledge in these fields of science. MacLachlan (2006) noted that in most countries, rapid urbanisation resulted in increased consumption of meat. This led to an increase in the reported incidence of cruelty to animals in slaughterhouses, leading to an increased public concern for the welfare of food animals. Public concern for the welfare of animals in western societies in the eighteenth century led to a diminishing view on anthropocentrism among the general population (Thomas 1984).

Advances in the science of animal behaviour and sentience over the years, aimed at eliminating avoidable pain and distress, have led to improvements in the handling and techniques of slaughter of food animals. Whilst these changes have been incorporated into conventional slaughter procedures, some religious authorities have forgone adopting some aspects of improved slaughter methods because they are apparently inconsistent with their beliefs (ASIDCOM Association, 2010; HMC, 2016). In most developed countries, there have been a series of animal welfare regulations implemented over the years to protect the welfare of animals during slaughter (eg The Humane Slaughter Act 1958; EC 1099/2009). These animal welfare policies are usually mandatory during conventional slaughter, however, during religious slaughter, there are exemptions regarding the use of modern slaughter technologies (e.g. pre-slaughter stunning). For instance, EC1099/2009 permits Member States to exercise an exemption that allows the slaughter of animals without stunning for people of faith (usually Muslims and Jews). The exemptions are necessitated by the fact that many religious authorities continue to argue that modern slaughter techniques are inconsistent with the teachings of their religious scriptures. It must be reiterated however,

that, most of the new slaughter technologies that are the subject of this discussion were developed or discovered many centuries after the religious texts were revealed, it is therefore not surprising that they are not mentioned in any of the religious literature. Nonetheless, a large proportion of Islamic scholars in the UK are of the view that the use of, for example, reversible electrical stunning is consistent with Halal slaughter (Fuseini *et al* 2017). This view is shared by Islamic scholars representing the major religious leads in Halal certification (e.g. the Malaysian MS1500 2009; Indonesian MUI HAS 23103 2012; UK HFA 2014). On the other side of the debate there are Halal Certification Bodies (HCBs) within the EU who vehemently reject all forms of stunning e.g. the Halal Monitoring Committee (UK), Halal Assure IP (UK) and AVS (France). Miele (2016) reported that the debate surrounding the acceptability of pre-slaughter stunning and other new slaughter technologies for Halal production is a relatively new phenomenon in the West. Miele (2016) noted that some 30 years ago, Muslims living in Europe did not question the Halal status of meat slaughtered conventionally because they regarded meat slaughtered by Christians and Jews (People of the Book) as Halal in line with commandments in the Quran (Quran 5:5). Until recently, Kosher meat was accepted by the UK's Halal Food Authority (HFA) as suitable for Muslim consumption and it is still being certified as such by another HCB, the Halal Consultations Ltd (HCL). Whilst some aspects of animal husbandry, transport and pre-slaughter handling may affect the Halal and *Tayyib* (foods that are deemed safe and wholesomeness) status of meat, little attention is usually paid to the *Tayyib* aspect of the food chain. The majority of non-Muslims and even some Muslims associate Halal meat with the final few seconds of the animal's life, that is, whether the animal was conscious during slaughter or not, and if the slaughter was performed by a Muslim.

The focus of this paper is on slaughter techniques or innovations developed over the years to improve animal welfare and the efficiency of slaughter, improvements in handling techniques

will not be covered in this paper since the present debate surrounding the Halal slaughter requirements does not normally extend to pre-slaughter handling. The paper also discusses the welfare of food animals from an Islamic perspective and highlights newer slaughter techniques (e.g. pre-slaughter stunning, mechanical slaughter and thoracic sticking) that are alien to the Islamic scriptures and have divided scholarly opinion within the Muslim community.

2. The *Halal-Tayyib* Concept

The word Halal is often used in relation to food that is suitable for consumption by Muslims. The opposite of Halal is Haram. The Quran and Hadith are the two main sources of Islamic food laws (Grandin and Regenstein 1994; Fuseini *et al* 2016a), giving guidance on the production, handling and slaughter of animals for food. A number of verses in the Quran lay emphasis on *the Halal-Tayyib* concept (Quran: 2:168; 5:88; 8:69). This encompasses all foods that are permissible (Halal) and wholesome (*Tayyib*). Hashimi, Saifuddeen, and Salleh (2010) defined *Tayyib* as anything that is good, pure or wholesome. In terms of its ethical significance, Arif and Ahmad (2011) defined *Tayyib* as the “moral virtues and obligations” related to the production and consumption of food. It is for this reason that the highest animal welfare standards should be met during the rearing, transport and slaughter of food animals for the meat to be fit for consumption by Muslims. Many will argue that current industrial practices pertaining to the husbandry, bioengineering and slaughter of animals fall short of the Islamic requirements. It must be noted that the *Halal-Tayyib* concept is seldom used, Demirci, Soon and Wallace (2016) reported that Muslims are faced with either interpreting Halal as a concept on its own, or in conjunction with *Tayyib* (*Halal-Tayyib* as a holistic approach). Riaz and Chaudry (2004) reported that during the earlier days of Islam, when there were no food safety policies, Muslims depended on Islamic dietary laws derived from the Quran for guidance on what was deemed permissible and wholesome. Although the

Muslim community differ widely in their interpretation of some of the Halal slaughter requirements, it is generally agreed that for meat to be Halal, the following conditions must be met (Regenstein *et al* 2003; Masri 2007; MS1500 2009; MUI HAS 23103 2012; Quran 5:3; Miele 2016):

- The animal must be healthy at the time of slaughter
- The animal must be a species accepted for Halal slaughter
- The slaughtering equipment (blade) must be surgically sharp, this must sever the main blood vessels in order to ensure rapid and sufficient blood loss which leads to death. Sufficient time must be allowed for the flowing blood to drain out of the carcass
- The person bleeding the animal must be a Muslim, the slaughterer is required to recite the name of God upon each animal before or during the neck cut

During Halal slaughter, in addition to the slaughterer being a Muslim, he/she is expected to have attained the age of discretion and must be sane (MS1500 2009; HFA 2014). Extensive literature reviews on the requirements of Halal slaughter have been published (Farouk 2013; Farouk *et al* 2014; Fuseini *et al* 2016b). Although the Muslim community generally agree on the above Halal slaughter requirements, some Muslims are reluctant to accept modern slaughter techniques because of the following fears:

- An animal potentially dying before the ritual cut is made, when animals are subjected to modern slaughter techniques (pre-slaughter stunning) (Adam 2016).
- The technique is not mentioned anywhere in the religious scriptures (e.g. pre-slaughter stunning, mechanical slaughter) (Adam 2016).
- The belief that the new technique may diminish the volume of blood loss (e.g. pre-slaughter stunning, mechanical slaughter) (Anil 2012).

- Doubts over the ability of the technique to sever the main blood vessels (e.g. mechanical slaughter).
- The belief that some new slaughter techniques (eg pre-slaughter stunning) are cruel (Fuseini *et al* 2017). EBLEX (2010) reported that some Muslims believe stunning is painful to animals.
- The belief that some new techniques impact negatively on meat quality (Anil 2012).

2.1 Food animal welfare in Islam

Despite some negative publicity in the media regarding animal welfare abuses by Muslims, particularly during Halal slaughter (note that equally prevalent are similar reports associated with non-Muslim abattoirs), the Quran and Hadith emphasise the need for Muslims to protect the welfare of animals in their care. In fact, some chapters of the Quran are even named after animals, presumably to highlight the significance of animals in Islam [see Quran Chapters 2 (The Cow), 6 (The Grazing Livestock), 16 (The Bee), 27 (The Ants), 29 (The Spider) and 105 (The Elephant)]. The Quran also recognises animals as sentient beings and compares them and human beings as the same communities in the following verse:

“And there is no creature on earth or the birds that fly with their wings except (that they are) communities like you” (Quran 6:38).

Some Muslims even hold a belief that animals have souls (Haque and Masri 2011). It is therefore not surprising that animals are recognised as creatures that praise God in the following Quranic verse:

“The seven heavens and the earth and whatever is in them exalt Him. And there is not a thing except that it exalts (Allah) by His praise, but you do not understand their (way of) exalting. Indeed, He is ever Forbearing and Forgiving” (Quran 17:48).

It has been reported that pre-Islamic Arabia was noted for their cruelty to animals. The people of Mecca used to cut off parts of live animals to eat and this was a widespread problem until the Prophet banned the practice in the following Hadith:

“Any part of the animal that is cut off whilst the animal is still alive is considered carrion and that part cannot be consumed (Haram)” (Tirmidhi 1480).

Bron (2006) noted that despite the Prophet’s upbringing in a culture that was noted for their cruelty to animals, he uniquely showed his love for animals in many instances and reminded Muslims of the significance of being kind to animals in the following Hadith:

”Whoever is kind to the creatures of God is kind to himself”.

In the area of animal welfare at slaughter, Islam emphasises *Ihsan* (perfection). Muslims are instructed to take appropriate steps in order to reduce suffering to animals during slaughter. The following Hadith highlights the need to sharpen the slaughter blade and be compassionate during Halal slaughter:

“Verily Allah has prescribed Ihsan in all things. So if you kill, then kill well; and if you slaughter, then slaughter well. Let each one of you sharpen his blade and let him spare suffering to the animal he slaughters” (Nawawi 40:17).

It is clear from verses of the Quran and extracts from *Ahadith* (plural of *Hadith*) cited above (and others not covered here) that Islam preaches compassion to animals, it is therefore a duty on Muslims to put it into practice. One may therefore argue that if the Prophet practiced the most welfare friendly methods of slaughter during his time, Muslims of today should strive to adopt slaughter methods that have been scientifically shown to improve animal welfare during slaughter.

2.2 Traditional Halal slaughter

Historically, Muslims have always slaughtered animals for food without any form of stunning. Although highly contentious from a modern animal welfare standpoint (Grandin,

2010), this method of slaughter is still widespread in the developing economies (Adzitey *et al* 2011; Frimpong *et al* 2012). This is principally due to economic reasons, the lack of animal welfare policy and the insistence by some Muslims in these countries that pre-slaughter stunning is contrary to the Islamic slaughter rules (Frimpong *et al* 2012; Annan-Prah *et al* 2012). It has been reported that even in the developed world, there is preference for meat slaughtered without stunning among Muslims (EBLEX 2010). This is because the majority of Muslims attach greater spiritual significance to meat from animals slaughtered in this manner (Farouk *et al* 2014), probably because it is the method that was practiced by the Prophet. Despite the widespread use of this method of slaughter in the developing world (and some parts of the western world), research has demonstrated that it is a painful procedure (Gibson *et al* 2009; Mellor *et al* 2009; Gregory *et al* 2010). It is against this backdrop that countries within the European Union (EU) and other industrialised countries make it normally mandatory for the pre-slaughter stunning of animals before slaughter (EC1099/2009; Humane Slaughter Act 1958). However, Nakyinsige *et al* (2013) however, pointed out that many Muslims are reluctant to approve pre-slaughter stunning for Halal production because of the belief that it violates the Halal slaughter rules by causing the death of animals before slaughter and also that stunning offers no animal welfare advantage compared with traditional Halal slaughter. These claims are backed by suggestions by some researchers that the slaughter of animals without stunning is as humane as pre-slaughter stunning, if not better (Schulze *et al* 1978; Bager *et al* 1992; Grandin and Regenstein 1994). Some have also argued that slaughter with a sharp blade is a form of stunning in its own right (e.g. All Party Parliamentary Group report on religious slaughter of lamb and beef 2014).

Nonetheless, Islamic scholars in some Muslim majority countries, including Indonesia (MUI HAS 23103 2012), Malaysia (MS1500 2009) and others have issued *Fatwas* (religious rulings) to approve pre-slaughter stunning, particularly for reversible or simple stunning.

Here reversible, is defined as that if no further action is taken following stunning, the animal would recover consciousness and would continue to live, uninjured and otherwise unharmed (Velarde *et al* 2002). This is an important requirement to be met during Halal slaughter. However, Zivotofsky and Strous (2012) questioned the effectiveness of reversible electrical stunning, they contested that reversible electrical stunning should not be considered as a solution to improving animal welfare and list several possible failings in the approach. These included the short duration of unconsciousness induced by the stun (especially in bovine animals) which can lead to animals recovering during bleeding out, re-stunning of ineffectively stunned animals (or non-stunned) and the incidence of broken bones during waterbath stunning of birds, which, according to the authors, may be painful. Conversely, it has been reported that objective recording of brain activity with EEG has shown that reversible stunning is a humane technique (Velarde *et al* 2002; EBLEX 2009; Wotton *et al* 2014; Orford *et al* 2016).

3 Modern slaughter techniques and Halal compatibility issues

3.1 Pre-slaughter stunning

European Council Regulation, EC1099/2009 defines stunning as “any intentionally induced process that causes loss of consciousness and insensibility without pain, including any process resulting in instantaneous death.” The aim of stunning therefore, is to disrupt normal brain function in order to induce immediate loss of consciousness so that the pain associated with the neck cut is abolished. Stunning can be achieved through the use of a mechanical device (e.g. a captive-bolt gun), gaseous mixtures or the use of an electrical apparatus to deliver sufficient current through the brain. Whilst some methods of stunning can support the full recovery of animals (e.g. head-only electrical stunning), there are other methods of stunning that are applied with the intention of causing the death of the majority of animals, and therefore do not aim to be necessarily recoverable (e.g. penetrative captive bolt stunning,

gas stunning and electric head-to-body stunning where the voltage spans the heart). The use of reversible stunning for Halal production is widely accepted by the Muslim community in New Zealand (Gilbert *et al* 1986), within the European Union (Dialrel 2010; Food Standard Agency 2012, 2015) and in some Muslim majority countries (MS1500 2009; MUI HAS 23103, 2012). The main reason for the approval of reversible stunning is that it ensures that a live and unconscious but otherwise essentially undamaged animal is presented at the final slaughter operation where it is exsanguinated.

It is worth mentioning that despite the growing popularity of reversible stunning during Halal slaughter, some Muslim authorities reject all forms of stunning. Opponents of Halal stunning usually put forward three explanations regarding the incompatibility of techniques for Halal slaughter, these explanations are outlined below:

3.1.1 Pre-slaughter stunning results in the death of animals before the neck cut.

Of paramount importance among the Halal slaughter rules is for the animal to be alive at the point of slaughter (Quran 5:3; Farouk 2013; Fuseini *et al* 2016a; Miele 2016). Farouk (2013) reported that the reason for the rejection of penetrative captive stunning for Halal slaughter by some Muslim authorities is because it is irreversible, with the potential to cause the death of animals before the Halal cut is made. Some Halal authorities incorrectly hold a view that ‘no form of stunning’ supports recovery, they have therefore adopted a blanket approach to reject all pre-slaughter stunning (HMC 2016; Adam 2016). The HMC is the UK’s largest certifier of un-stunned Halal meat, in an email response to the question of why the organisation does not certify stunned meat as Halal, they indicated that “the HMC does not certify any type of stunning and does not envisage certifying any type of stunned animals in the future” (Personal communication, to Fuseini 2015). Fuseini *et al* (2017) conducted a survey of Islamic scholars in the UK which reported that out of the 65 respondents, 58% of them indicated that they were not aware that some methods of stunning have been shown to

be reversible, a further 69% reported that they did not agree that stunning could be used to reduce the pain associated with slaughter.

Contrary to the belief by some Muslim authorities that all forms of stunning result in the death of animals before the Halal cut, research has demonstrated that electrical head-only stunning of animals does not result in instantaneous death (Velarde *et al* 2002; EBLEX 2009; Wotton *et al* 2014). Orford *et al* (2016) reported the presence of a normal heartbeat following head-only stunning of sheep and lambs, this demonstrated the reversibility of the technique. This has provided some assurance to the Muslim community that some methods of stunning may be suitable for use during Halal slaughter and some Muslim authorities have therefore approved this method of stunning for Halal compliance (Riaz and Chaudry 2004; Anil *et al* 2006; Nakyinsige *et al* 2013; Masri 1989; MUI HAS 23103 2012; MS1500 2009; HFA 2014).

3.1.2 Pre-slaughter stunning affects the volume of blood loss at exsanguination.

Followers of the Islamic faith are forbidden to consume blood (Quran 5:3, 6:145; Regenstein *et al* 2003). In the Quran 6:145, reference is specifically made to flowing/pouring blood, which confirms that residual blood in carcasses is not the focus of the Quran (Masri 2007; Farouk *et al* 2014). Many Muslims therefore insist that sufficient time must be allowed for sufficient flowing blood to drain out of carcasses before further processing (HFA 2014; MS1500 2009). It must be noted that regardless of how long the carcass is allowed to bleed-out, some quantity of blood will be retained in it. Kotula and Helbacka (1966) reported that it is a common practice among some religions (e.g. Judaism) to purge blood vessels in order to remove residual blood. Opponents of stunning for Halal slaughter have suggested that pre-slaughter stunning of animals can obstruct blood flow, leading to the retention of more blood in carcasses (in comparison with slaughter without stunning) (HMC 2016; Nakyinsige, *et al* 2013). The most important aspect of bleeding an animal is to reduce blood pressure as

quickly as possible to interrupt the supply of oxygenated blood to the brain, to promote the death of the animal (Gregory 2008). Anil (2012) reported that there is the need to bleed-out animals properly in order to remove harmful blood constituents and improve the keeping quality of meat. The removal of harmful microbes, extending the shelf life of carcasses and protecting public health may have been the reasons why blood removal from carcasses was emphasised in the Quran, against the background that there was no refrigeration equipment at that time.

There has been extensive research comparing the volume of blood loss during different slaughter methods (including slaughter without stunning). The greater majority of the researchers have concluded that there is no difference in the amount of blood loss, irrespective of the method of slaughter used (with or without stunning) (Anil *et al* 2004, 2006; Velarde *et al* 2003, Gomes Neves *et al* 2009; Khalid *et al* 2015). Khalid and others (2015) compared the blood loss in 440 lambs using 3 slaughter protocols; slaughter without stunning, electric head-only stunning and post-cut electrical head-only stunning. They concluded that there was no significant difference in the volume of blood loss between the 3 treatments. Velarde *et al* (2003) found a slight improvement in the volume of blood loss when lambs were subjected to slaughter with stunning (electrical) in comparison with traditional Halal non-stun slaughter.

3.1.3 Pre-slaughter stunning may not be a humane procedure.

As stated above, Islam emphasises the need for the welfare of animals to be protected prior to and during Halal slaughter. It is for this reason that any method used to slaughter animals for consumption by Muslims must not cause any pain greater than the threshold that would otherwise be inflicted by traditional Halal slaughter (slaughter without stunning). However, some Muslims, including Islamic scholars and Halal consumers, are of the opinion that pre-slaughter stunning of animals causes pain during its application and it is therefore a cruel

procedure (Katme 2012; Fuseini *et al* 2017; Adam 2016; HMC 2016). There is no scientific evidence (as far we are aware) to suggest that pre-slaughter stunning is a painful procedure. The humaneness of stunning has been widely investigated and many researchers have concluded that when applied correctly, stunning is a humane procedure (Cook *et al* 1993; Leach *et al* 1980; Daly and Simmons 1994; Blackmore 1979; Daly *et al* 1985, Lambooij 1980) and on this scientific evidence it has become a legal requirement, for the protection of animal welfare, in very many countries around the world. As such, proponents of stunning for Halal slaughter therefore emphasise the need for any stunning method approved for Halal slaughter to be humane (MS1500 2009; MUI HAS 23103 2012; HFA 2014).

3.2 Mechanical (machine) slaughter of poultry

The use of fixed mechanical blades to slaughter birds for Halal production continues to divide opinion among Islamic scholars. Gregory and Wilkins (1989) noted that when applied correctly, mechanical slaughter equipment can be used to effectively slaughter birds by severing the trachea, the two carotid arteries and both jugular veins. Guerrero-Lagarreta and Hui (2010) reported that industrial halal poultry production can be achieved through slaughter by hand or the use of machines. With modern processing lines for poultry operating at high speed, e.g. 10,000 birds per hour, manual neck cutting requires several operatives in-line. The use of a series of slaughter operatives results in significant delays between stunning and neck cutting with some birds that introduces additional welfare issues. It could take up to a minute or more for birds to reach the last slaughter operative after exiting the stun bath. In spite of the fact that the acceptability of mechanical slaughter for Halal production is highly controversial, it has been reported that the practice is gaining acceptance among Muslims (Wan Hassan 2007). In recent years, there has been numerous *Fatwas* for and against this method of slaughter. The Malaysian authorities (MS1500 2004) accepted machine slaughter until it was recently removed from their current Halal standard (MS1500 2009). In addition,

the UK's Halal Food Authority (HFA) previously accepted mechanical slaughter (HFA 2010) but recently withdrew their use from their standard (HFA 2014). In the UK, the use of mechanical slaughter is exclusively accepted for Halal production by the Halal Consultations Limited (HCL 2016), however, there has been extensive efforts from a segment of the UK Muslim community to get the practice banned for domestic production (Halal Focus 2014; Meat Trades Journal 2016; News Halal 2016). Chaudry *et al* (2000) reported that provided that the machine is capable of severing the 2 jugular veins, trachea and oesophagus, machine slaughter should be permitted during Halal slaughter. It is worth noting that within the EU, it is a legal requirement to sever both carotid arteries, the method described by Chaudry *et al* (2000) would therefore not meet the legal requirement because this method does not take into consideration the severance of the carotid arteries. According to these authors, a Muslim is required to stand in close proximity to the machine and must continually recite the *Tasmiyyah* (a short prayer) and that a back up slaughterer is also required to slaughter any birds that miss the blade. Issuers of *Fatwa* against mechanical slaughter usually argue that during mechanical slaughter, the following conditions may not be met (Eat Halal 2013):

- The recitation of the *Tasmiyyah* on every bird.
- The effective severance of the main blood vessels in the neck region of birds.
- The slaughterer (in this case the person reciting the *Tasmiyyah*) must be either a Muslim or People of the Book (Christians and Jews).

Table 1 is a compilation of comments made by some prominent Islamic scholars and Muslim organisations regarding the permissibility of mechanical slaughter for Halal production.

The lack of consensus on the acceptability of mechanical slaughter for Halal production has created confusion among Halal consumers and Food Business Operators (FBO), this is also hampering efforts at establishing a global Halal standard. Wan Hassan (2007) noted that the inability of Halal Certification Bodies to agree on a common ground on some aspects of

Halal slaughter (including mechanical slaughter), has prevented the International Halal Integrity Alliance (IHIA) from fulfilling its role of establishing a global Halal standard. According to Wan Hassan, the IHIA was founded in 2006 at the World Halal Forum (Kuala Lumpur, Malaysia 2006) to create a platform for Halal Certification Bodies and other stakeholders to share ideas and work towards a unified global Halal standard. It has been a decade since the formation of the IHIA and the formation of a global Halal standard remains a work-in-progress.

[INSERT TABLE 1 ABOUT HERE]

3.3 Thoracic sticking

Drawing a knife across the neck of animals to make a transverse cut to sever the main blood vessels in the neck region is the recommended method of Halal slaughter, with the exception of camels, where they are slaughtered in a standing position with a chest stick or thoracic stick (Khalid 2015). However, Leigh and Delany (1987) suggested that throat cutting of bobby calves after electrical head-only stunning may be inhumane because electrical stunning induces only a short period of unconsciousness, animals may therefore recover from the stun during bleeding-out. Severing the brachiocephalic trunk close to the heart may prevent the recovery of animals during bleeding-out, this ensures dramatic loss of blood pressure to accelerate the death of the animal. It has been shown that thoracic sticking can achieve the reduction of blood pressure to almost zero in 8 s (Anil *et al* 1995), thus cutting off the supply of oxygenated blood to the brain to promote death. Leigh and Delany (1987) explained that thoracic sticking was achieved by inserting a knife through the thoracic inlet to sever the brachiocephalic trunk.

Despite the animal welfare and potential meat quality advantages associated with thoracic sticking (by promoting death and preventing the recovery of stunned animals during bleeding-out) (Anil *et al* 1995; Mulley, Felapau *et al* 2010), it appears that the majority of

HCBs and Islamic jurists do not consider it a Halal compliant method of slaughter, when used as the main method of slaughter (HFA 2014; MUI HAS 23103 2012), except for camels as noted above. This may be partly due to the fact that the method was not practiced at the time of the Prophet for all species of animals. Farouk (2013) reported that thoracic sticking is used during Halal slaughter in some parts of the world however, it is not accepted as a main method of slaughter as it is normally performed 30 s after the Halal cut (Farouk 2013), whilst other Halal authorities require up to 2 minutes delay (Robins *et al* 2014). Jais, Isa and Yusof (2016) reported that the Malaysian *Fatwa* Council convened a special seminar in 2005 to debate the possibility of using thoracic sticking during Halal slaughter. The council concluded that thoracic sticking could not be used as the main Halal method of slaughter, but accepted, it was permissible to thoracically stuck animals after the Halal cut if the following conditions, as laid out by the *Fatwa* Council were met:

- The initial procedure (Halal cut) must sever the following blood vessels; the 2 carotid arteries, the gullet and the windpipe.
- The thoracic stick must be performed at least 30 s after the Halal cut.
- The main cause of death must be the Halal cut and not the thoracic stick. The thoracic stick should only be used to aid blood loss and not be the main cause of death.

It is possible to meet the first two conditions above however, it may not always be possible to ensure that death is wholly caused by the Halal cut rather than the thoracic stick. This is particularly difficult in cattle where death can be delayed to up to 2 minutes (or more) due to continued supply of oxygenated blood to the brain through the vertebral arteries, when false aneurysms form at the cut ends of the carotid arteries (Gregory *et al* 2008). This implies that although the thoracic sticking may be delayed for up to 30s, at the time of initiation, the animal may not be “dead” at this stage. The animal welfare implications of delayed loss of unconsciousness when cattle are slaughtered without stunning have been widely reported

(Daly et al 1988; Gregory et al, 2009; Gregory et al, 2010). Daly et al (1988) reported that the time taken for the loss of cortical brain function in cattle was up to 126 s whilst Blackmore (1984) observed that cattle slaughtered in an upright position without stunning took up to 135 s to physically collapse (early sign of the onset of unconsciousness). In some cases, after the Shechita cut, some cattle have attempted to escape after initially collapsing (Levinger, 1976). It has been suggested that a higher neck cut position (above the conventional neck cut position) can reduce the incidence of false aneurysms (Gregory et al, 2012, Gibson et al, 2015) particularly during Halal slaughter without the use of thoracic sticking. In fact Gibson et al (2015) showed that performing a high neck cut during Halal slaughter without stunning significantly reduced the time to final collapse of cattle.

4 Animal welfare implications and conclusion

Muslims are instructed to protect the welfare of animals under their care. The Quran and *Hadith* stress the need for the slaughter process to be carried out as swiftly as possible with the aid of a sharpened blade, this is to ensure that the major blood vessels in the neck are severed to ensure rapid blood loss and death. It is for this reason that many have suggested that the Islamic method of slaughter, revealed some 1400 years ago would have been the most welfare friendly method of slaughter at the time. Proponents of modern slaughter techniques for Halal production have argued that if the Prophet used what was described as “best practice” during his time, it is imperative for present day Muslims to protect animal welfare by adopting scientifically validated slaughter techniques such as recoverable pre-slaughter stunning, mechanical slaughter (to reduce the time between stunning and the neck cut in comparison with slaughter by hand by several slaughtermen) and thoracic sticking. Opponents of these methods of slaughter have on the other hand argued that such slaughter techniques do not fully comply with the Halal slaughter rules, in addition, they also insist that since the Prophet did not use them during Halal slaughter, they are inconsistent with the

Prophetic teachings on slaughter. Many FBOs and stakeholders have called for an urgent unification of all standards to form a global Halal standard but the inability of Islamic jurists and Halal Certification Bodies to agree on the acceptability of modern slaughter techniques has meant that the debate will continue. It is hoped that a unified global Halal standard would include animal welfare-friendly slaughter techniques.

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Table 1. Comments made by some Islamic scholars and Muslim organisations regarding the compatibility of mechanical slaughter for Halal production.

Name of scholar/ Organisation	Main comments	Source
Ebrahim Desai	If the poultry are conveyed to a single fixed blade controlled by a Muslim, that meat is not Halal. But if birds are transported to several fixed blades each controlled by a Muslim, the meat would be Halal	http://www.halalhmc.org/IssueOfMSandStunning.htm
Mufti Khalid Saifullah Rahmani	If a Muslim recites the <i>Tasmiyyah</i> whilst birds are slaughtered by a machine, only the first bird will be Halal, the rest would not be Halal.	Jadeed Fiqhi Masaa'il, Page 219, Vl. 2

Mufti Muhammad ibn Adam al-Kawthari	Mechanical slaughter would be deemed as Haram unless the following conditions are met: 1. The 2 jugular veins, trachea and oesophagus must be cut with a sharp blade 2. The <i>Tasmiyyah</i> must be recited at the time of slaughter 3. The slaughterer must be either a Muslim, Jew or Christian	http://www.halalhmc.org/IssueOfMSandStunning.htm
GMWA Food Guide	The question around the acceptability of mechanical slaughter is whether the <i>Tasmiyyah</i> can be recited on each bird. If a third party recites the <i>Tasmiyyah</i> while the slaughterer remains quiet, the meat would be Haram	Fatawaa Alamghiriyyah P. 286. Vol. 5

Board of Scholars (Halal Food Authority-UK)	<p>“In our view, the static conventional instrument of slaughter has now been transformed into a dynamic mechanical knife that facilitates mass production without compromising halal standards”. We therefore declare mechanically slaughtered meat as Halal</p> <p>This organisation no longer approves mechanical slaughter</p>	http://www.eat-halal.com/mechanical-slaughter-is-allowed/
Halal Consultations Limited (UK)	<p>“All the certifier of Halal has to do for mechanised killing is ensure that the bird is not decapitated (or dead), the words of <i>Tasmiyyah</i> are recited, as required, and animal welfare rules are adhered to”</p>	http://halalconsultations.com/mechanical-killing/